

WHAT IS CLAIMED IS:

1 1. An antenna array system comprising:
2 a plurality of spaced antenna elements; and
3 a controller coupled to the antenna elements, the
4 controller determining a magnitude and phase relationship
5 between a first signal sample taken at a first antenna
6 element at a first time and a second signal same taken a
7 second antenna element at a second time, the controller
8 employing the magnitude and phase relationship to compute a
9 projected signal sample for a virtual antenna element based
10 on a second signal sample taken at the first antenna
11 element at the second time.

1 2. The antenna array system according to claim 1,
2 wherein the projected signal sample is employed as a signal
3 sample taken at the virtual antenna element at the first
4 time.

1 3. The antenna array system according to claim 1,
2 wherein the plurality of antenna elements are linearly
3 aligned, the antenna array system further comprising:

4 a plurality of mixers each mixing a signal
5 received at one of the antenna elements with a local
6 oscillator frequency signal;

7 a plurality of analog-to-digital converters each
8 receiving a mixed output from one of the mixers and
9 converting the mixed output to a digital signal, wherein
10 the controller receive the digital signals and computes the
11 projected signal sample based on the digital signals; and

12 a digital signal processor receiving the digital
13 signals from each of the analog-to-digital converters
14 together with the projected signal sample from the
15 controller.

1 4. The antenna array system according to claim 1,
2 wherein the antenna array system has a beamformed array
3 gain and half power bandwidth proportional to a number of
4 antenna elements greater than a number of the plurality of
5 antenna elements.

1 5. The antenna array system according to claim 1,
2 wherein the controller determines multiple magnitude and
3 phase relationships between signal samples taken at
4 different antenna elements at different times and computes
5 a plurality of virtual signal samples.

1 6. The antenna array system according to claim 5,
2 wherein the antenna array system has a beamformed array
3 gain and half power bandwidth proportional to $M+P \cdot (M-1)$,
4 where M is a number of the plurality of antenna elements
5 and P is a number P of the virtual signal samples.

1 7. The antenna array system according to claim 1,
2 wherein a virtual sensor is achieved by blind mapping,
3 without movement of antenna array elements.

1 8. An antenna array system comprising:
2 a plurality of arrays of patch antennas arranged
3 in rows and columns, wherein signals from each of the patch
4 antenna within a given array are summed in phase; and
5 a multi-element digital beamformer phasing
6 signals from each of the plurality of arrays to a single
7 point.

1 9. The antenna array system according to claim 8,
2 wherein each of the arrays is perturbed in elevation angle
3 with respect to the remaining arrays.

1 10. The antenna array system according to claim 8,
2 further comprising:

3 low noise amplifiers connected to feed points for
4 each of the plurality of arrays; and

5 a downconverter operating on outputs of the low
6 noise amplifiers.

1 11. The antenna array system according to claim 10,
2 wherein the antenna elements, low noise elements, and
3 downconverter are implemented within one module coupled by
4 a fiber cable to a digital signal processor.